

**Barrier Delineators:**  
*Field Performance Study and Research  
Findings of Alternative Barrier  
Delineators*

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**Published by:**

UDOT Research Division,  
Transportation Products Development Group (TPDG)

**July 1997**

## UDOT RESEARCH & DEVELOPMENT REPORT ABSTRACT

<b>1. Report No.</b> <div style="text-align: center;">UT-97.07</div>		<b>2. Government Access #</b>		<b>3. Recipient's Catalog #</b>	
<b>4. Title and Subtitle</b> Barrier Delineators: Field Performance Study and Research Findings of Alternative Barrier Delineators		<b>5. Report Date</b> July 1997			
		<b>6. Performing Organization Code</b>			
<b>7. Author(s)</b> Squire, Brandon S. Basha, Mujeeb A. Sharp, R. Barry		<b>8. Performing Organization Report #</b>			
<b>9. Performing Organization Name and Address</b> Utah Department of Transportation 4501 Constitution Blvd. Salt Lake City, UT 84119-14840		<b>10. Work Unit #</b>			
		<b>11. Contract #</b>			
<b>12. Sponsoring Agency Name &amp; Address</b> Utah Department of Transportation 4501 Constitution Blvd. Salt Lake City, UT 84119-14840		<b>13. Type of Report and Period Covered</b> Internal & External Research Report 1995-1997			
		<b>14. Sponsoring Agency Code</b>			
<b>15. Supplementary Notes</b>					
<b>16. Abstract</b> <p>The following technical report, prepared by the research division, is on the subject of barrier delineators and their field performance. This summary of a one-year experimental field study is followed by a recommendation by the research department for a more durable barrier delineator.</p> <p>The objective of this project was to find a more durable, cost-effective top-mounting barrier delineator to help solve an existing maintenance problem with barrier delineators. Problem have been reported, by the maintenance divisions, that barrier delineators were being damaged by snow removal operations. Research was done to find some possible alternatives to the current barrier delineator being used. Six different barrier delineators were tested including the current one being used. The six mile long test section was located at approximately mile marker 114 on eastbound I-80 by the Salt Lake International airport. Approximately thirty replicates of each of the six experimental barrier delineators were mounted on top of the concrete barriers and bridge parapets of the test section in July of 1996. After one winter season, the final data was collected and some conclusions were made. The Flexx 2020 barrier delineator would be an ideal choice if a side mounting barrier delineator was ever needed. This delineator would also be a good choice for a top mounting barrier delineator for temporary barriers. For permanent barriers, the extruded aluminum barrier delineator would be an excellent choice due to its durability. The use of these recommended barrier delineators will reduce the life cycle maintenance costs and will lead to a noticeable time savings.</p>					
<b>17. Key Words</b> Top-Mounted, Barrier, Delineator			<b>18. Distribution Statement</b> <div style="text-align: center;">UNLIMITED</div>		
<b>19. Security Classification (of this report)</b> UNCLASSIFIED	<b>20. Security Classification (of this page)</b> UNCLASSIFIED	<b>21. # of Pages</b> 13 pp. Report and 8 pp. Appendices	<b>22. Price</b>		

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## **Introduction**

### ***Background Information***

Problems with the top mounting barrier delineators have been reported by the maintenance division. The major problem is that the delineators are being damaged from snow plow operations. During snow removal the delineators are being broken or permanently bent back by the force of the snow being pushed aside by the snow plows. This is not only a maintenance problem but also a safety problem due to reduced effective reflective area. The maintenance division has requested research into determining a better top mounting barrier delineator.

### ***Definitions and Purpose***

During the daytime, barrier delineation can be accomplished by the use of pavement markings. However, during severe weather and at night, barrier delineation usually depends upon retroreflective elements. Barrier delineators are retroreflective units that mount on guardrails, concrete barriers, and bridge parapets. They are white or amber to conform with the pavement markings they supplement. The reflective units are typically made of retroreflective sheeting or prismatic retroreflectors [1]. Maintenance crews are finding that either the bracket or the reflective unit is being damaged. A barrier delineator that is durable, easy to install, and economically feasible is desired.

## **Current Practice**

### ***Maintenance Practice***

UDOT currently uses, Davidson Plastic's PCBM-15 thermoplastic barrier delineator when replacing damaged barrier delineators. Also, an aluminum unit locally available from Safety Sign and Supply, Salt Lake City, Utah. They are finding out that these delineators are not very durable in Utah's harsh climate. The department is replacing hundreds of these each year. To date they have not found a good replacement for the PCBM-15 or the aluminum version.

### ***UDOT Standards***

The 1994 UDOT Standard Specification 804, Barrier Reflectors, calls for either a rust resistant metal or a high impact thermoplastic, which is also resistant to ultraviolet radiation, for the barrier delineator. A standard specification is given on page "A-1" of Appendix A. Also, the standard drawings for depicting details for barrier delineation devices are found on pages "A-2" to "A-3" of Appendix A. Currently UDOT is installing the PCBM-15 thermoplastic barrier delineator. Either epoxy or metal anchors are used to fasten the delineators to the barriers.

### ***Maintenance Cost History***

Historical costs for the maintenance activity identified as "reflector maintenance" was queried in the MMS database. These costs would also include post mounted delineators and is not just the cost to repair barrier delineators. This does show that reflector maintenance is a costly procedure. Region 1 is used as a typical example for the average yearly cost between 1992 to 1995.

Activity Summary Inquiry for  
"Reflector Maintenance"  
for Region 1 from 1992 to 1995

Average cost/year

Labor = \$76,330

Equip = \$9,160

Matls.= \$27,830

(Source : UDOT MMS)

As seen in the previous data, reflector maintenance can be a significant cost burden to

the maintenance budget. These costs are provided for information only; since reflector maintenance is variable, a total item life-cycle cost cannot be accurately tracked. An attempt is made, in the last section of this report in the form of new product recommendations, to determine a more cost effective barrier delineator. A full report on post-mounted delineators is given in the UDOT Report #: UT-97.03 published by Research and Development.

### **Top Mounted Barrier Delineation Performances**

#### ***An on-going experimental test***

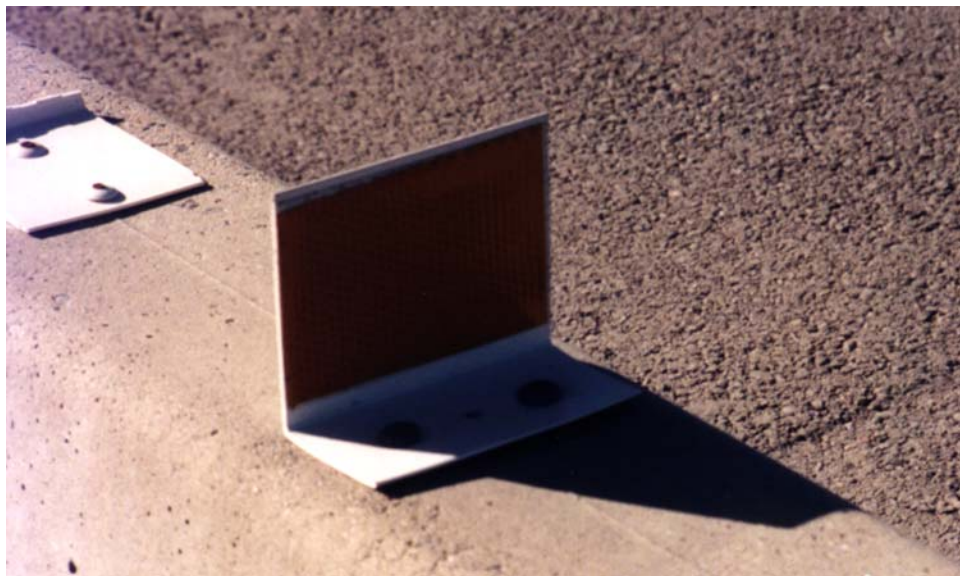
This test section is spread out over six miles. The section starts at approximately mile marker 114 on eastbound I-80 by the Salt Lake International airport. Barrier delineators were installed in July 1996 on the all of the concrete barriers and bridge parapets on the right side of the roadway. Six different brands of top-mounting barrier delineators were tested. Approximately thirty replicates of each were tested. An intermediate evaluation was performed in December of 1996, halfway through the '96/'97 winter season. It was found that the galvanized steel delineators were not holding up as well as the other products. The final performance evaluation was made during mid-June of 1997. These barrier delineators will be left out in the field to make it possible to make future evaluations.

## **Barrier delineation products**

### ***PCBM-12***

This is a shorter version of the current barrier delineator now in use. It is manufactured by Davidson Plastics. The product is a white L-shaped plastic bracket which has a reflector size that is 4.25"x3". This product had a install time of forty-five seconds and was anchored with two 1" steel anchors. The cost of the product is a \$1.45 each.

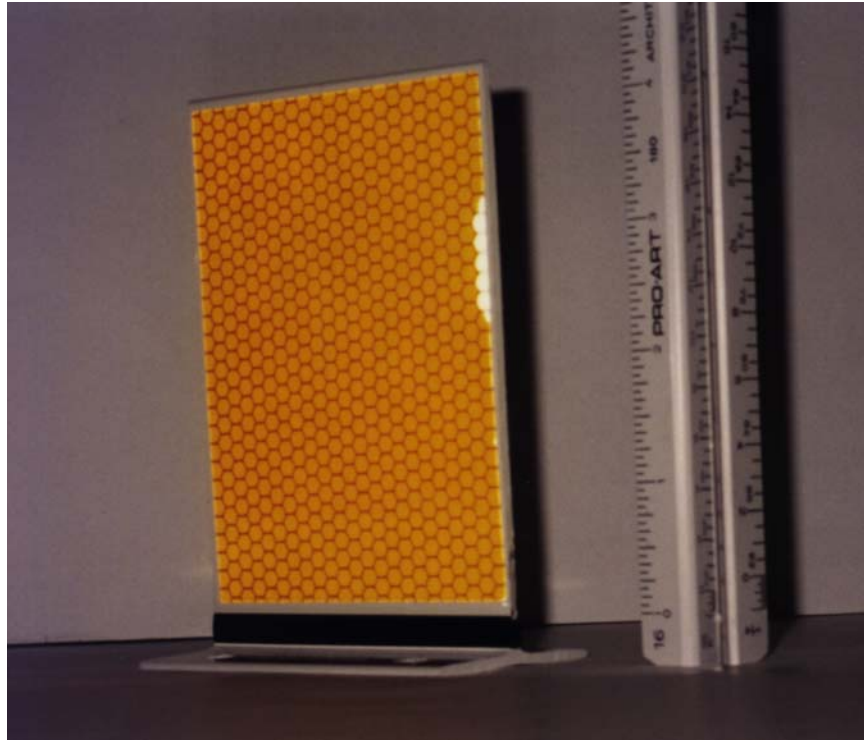
Thirty-nine of these were installed starting at mile post 114.5. A picture of the PCBM is shown below.



**PCBM-12**

### ***Flexx 2020***

The Flexx 2020 is manufactured by the Duraflex Corporation. This product is a white T-shaped plastic delineator with a flexible hinge. The reflector has a dimension of 3"x4". An install time of two minutes each was recorded and this product was anchored with two 1" shot driven pin nails. Flexx 2020 delineators cost \$2.75 per delineator. Thirty-three replicates were installed starting at mile post 116.5 and 118. A picture of the Flexx 2020 is shown below.

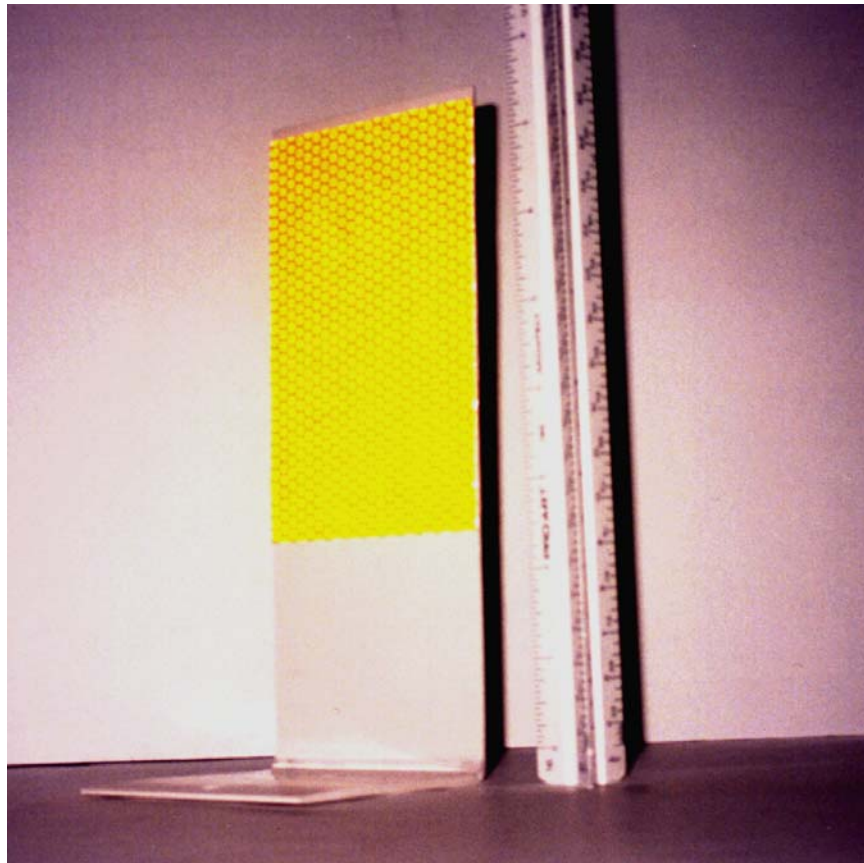


**Flexx 2020**



### ***PCBM-15***

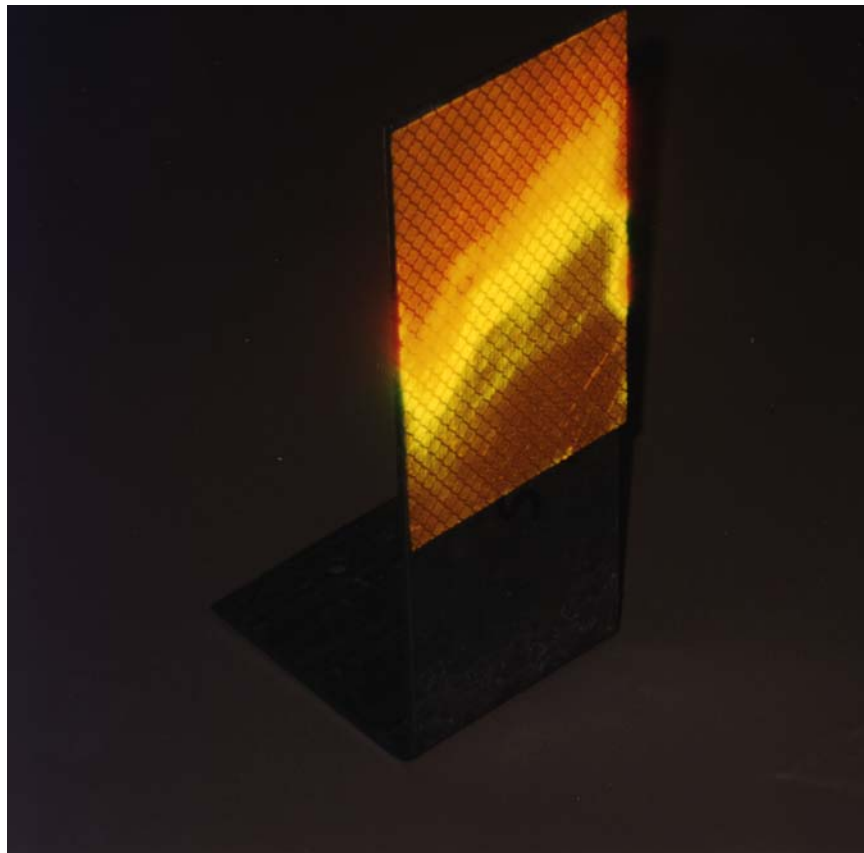
This is the product that is currently being used by UDOT. The PCBM-15 is the larger version of the PCBM-12 and is also manufactured by Davidson Plastics. This has a possible reflector area of 3"x8". Each delineator costs \$2.35 and twenty-nine replicates were installed. PCBM-15's were installed by using two 1" shot driven pin nails. An install time of two minutes each was recorded. These were installed at mile post 118 on the on-ramp. The PCBM-15 is shown in the picture below.



**PCBM-15**

### ***Galvanized Steel***

Galvanized Steel delineators use the same design as the PCBM-15 plastic delineator. They are manufactured by Syro Steel Company and cost a \$4.40 each. Thirty-five replicates were installed starting at mile marker 119 with an install time of two minutes each. Anchorage was obtained using two 1" shot driven pin nails. A picture of the galvanized steel delineator, manufactured by Syro Steel, is shown below.



**Syro Steel Galvanized Delineator**

### ***Extruded Aluminum***

This is an extruded aluminum L-angle that is 3/8" thick. It is a product of Flasher Barricade and has a reflective surface of 3"x6". An installation time of one minute was recorded and twenty-nine replicates were installed. They were anchored using two 1.25" steel nail drive anchors and were installed at the location of mile post 119.5. This delineator cost \$3.50 per unit. An extruded aluminum delineator is shown below.



**Extruded Aluminium Delineator**

### ***JD-1***

The JD-1 is manufactured by Astro Optics and costs \$3.65 per unit. These delineators consist of a T-shaped stiff plastic with a 5"x3" prismatic reflector. They were attached to the concrete barriers using a Carbolite adhesive. The barriers were cleaned with paint thinner and a brass wire brush. An installation time of one minute was recorded and twenty-nine were installed at mile marker 120. Astro Optics' JD-1 is pictured below.



**JD-1**

## **Field Research Evaluation**

### ***Experimental Test Objectives***

The main objective of this experimental feature was to find a cost effective barrier-mounted delineation marker that can withstand the impact of the snow and remain in an upright position. Research goals for this experiment test section included the following evaluation criteria: durability through seasons, barrier delineator mortality rate, ease of replacement, time expended to install, and a cost comparison.

### ***Time Study Results***

The results are summarized in the Performance Table below.

**Performance Table**

<b>Product Description</b>	<b>Number Missing</b>	<b>Cost per bracket</b>	<b>Install Time</b>	<b>Comments</b>
PCBM-12 (short) Davidson Plastics	0	\$1.45	45 sec.	Will be covered by snow. No sign of bending.
Flexx 2020 Duraflex Corp.	2 ( 1 due to anchor pullout)	\$2.75	2 min.	Flex Hinge is still flexible. No sign of permanent deformation.
PCBM-15 (currently used) Davidson Plastics	1	\$2.35	2 min.	Slightly bent back with some elastic rebound. Nails are rusted.
Galvanized Steel Syro Steel	7	\$4.40	2 min.	All bent back considerably due to impact. Do not rebound from impact.
Aluminum Flasher Barricade	0	\$3.50	1 min.	Very durable. Could be a road hazard if removed from barrier.
JD-1 Astro Optics	6	\$3.65	1 min.	Sheared at base. Adhesive works well. Not durable. Will be covered by snow.

## ***Discussion***

Galvanized Steel delineators, manufactured by Syro Steel, performed very poorly and also had the greatest cost. This delineator would not be a good choice due to the fact that they are expensive and they have permanent deformation from impacting snow. Figure 1 of Appendix B shows a typical example of this. These delineators also had the highest mortality rate. A reason attributed to this is that since they are one of the stiffer delineators they can tend to pry the anchors out of the concrete when impacted. Astro Optics JD-1 also did not perform very well. The adhesive used seem to work very well but the delineator itself cannot withstand an impact. This low impact resistance is illustrated in Figure 2 of Appendix B. Most of the missing delineators were sheared at the base. The JD-1 had excellent retroreflectance but it also was too short and would be covered by snow.

The PCBM delineators are also not the best choices. PCBM-12 performed well but they will also be covered by snow during the winter months. PCBM-15 is the current barrier delineator being used and this is not performing as well as the department would like them to perform. These barrier delineators tend to break at the 90 degree bend and they also tend to have permanent backward deformation. A typical PCBM-15, which has become bent backward is shown in Figure 3 of Appendix B. A 5/16" radius bead has been applied at the 90 degree bend to help improve the earlier versions of the PCBM-15 but they still do not perform as well as other barrier delineators.

The Flexx 2020 delineators performed very well and would be a good alternative to the current delineator. These delineators are very flexible and can withstand the impact of the snow pushed aside from the snow plows. Two out of thirty-three were damaged or missing. Figure 4 of Appendix B pictures the only broken Flexx 2020 recorded. One out of the two that were damaged or missing was due was due to poor anchoring. Flexx 2020's Flex-hinge was still flexible and did not seem to be cracking or deteriorating. Literature for the Flexx 2020 is located in Appendix C. Flasher Barricade's extruded aluminum barrier delineator is the most durable delineator tested. This delineator costs

approximately one dollar more than the PCBM-15 delineator currently used. Out of twenty-nine replicates tested not a single one has been damaged. This barrier delineator is ideal for permanent barriers. One problem that might exist is that if this delineator was ever dislodged from the barrier it may become a road hazard. This will most likely not be a problem since none of these delineators failed during the testing.

### ***Recommendations***

The goal for this project was to find a more durable cost-effective top-mounting barrier delineator. From this field performance study, two different barrier delineators are recommended. The first is the Flexx 2020. *The Flexx 2020 barrier delineator is recommended to be used for temporary barrier.* Flexx 2020 barrier delineators are very flexible and are cost effective. *Flexx 2020's can also be used as a side-mounted barrier delineator.* Since side-mounted barrier delineators take more abuse, the very flexible Flexx 2020 would be ideal. *For permanent barriers, such as bridge parapets and guard rails, the very durable extruded aluminum barrier delineator is recommended.* These delineators are not effected by the impact of snow removal operations and are very strong barrier delineators. They cost approximately a dollar more per delineator than the current barrier delineator but with reduced maintenance costs, the life cycle value is more cost effective.

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### **Endnotes**

1. Migletz James, Joseph Fish, and Jerry Graham: Roadway Delineation Practices Handbook, FHWA Report No. FHWA-SA-93-001 (August 1994); p. 148.

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Utah Department of Transportation "UDOT Report #UT-97.03", UDOT Research Division, Transportation Products Development Group, 4501 Constitution Blvd., Salt Lake City, UT 84119-5998.



## Appendix B



**Figure 1- Bent Galvanized Delineator**



**Figure 2-**

**Broken JD-**

**1**

**B1**



**Figure 3- Bent**

**PCBM-15**



**Figure 4- Broken Flexx 2020**

**B2**